

Sheet (4)

Multi-stage Switching

1. For a non-blocking (2048x2048) switching network. Calculate the minimum number of switching elements for each of the following cases:

- a. Single-stage switching.
- b. Two-stage switching.
- c. Three-stage switching.

Then design the case that require minimum cost.

2. For a non-blocking three-stage switching network ($N \times N$) prove that $n = (N/2)^{1/2}$ minimizes the number of switching elements, where n is the number of inlet/outlet per block.

3. Two three-stage switching networks (512x512) are designed. For each network, the number of inlets per block on the first stage $n=16$. The number of blocks on the second stage K is given as follows:

- Network 1: $K=32$.
- Network 2: $K=64$.

For each network, state if the network is blocking or not.

4. A switching network ($N \times M$) connects N inputs M outputs. Two switching networks are described as follows:

- Networks 1: two-stage (256x256), each block is 16x16 switching matrix.
- Networks 2: two-stage (256x256), each block is 16x64 switching matrix.

For each network:

- a. State if the network is blocking or not.
- b. Calculate the switching capacity (S.C), the number of simultaneous calls (sim-calls), the number of switching elements (S) and the cost of system.

5. (report) Design a three-stage (200x200) switch ($N=200$) with $k=4$ and $n=20$. Calculate the switching elements and the cost of system and comparison with single-stage.

6. (report) Redesign the previous three-stage (200x200) switch using the minimum number of cross points.

7. For (2048x2048) three-stage switching with ($n=32$, $p=0.2$). Find P_B for the following:

- a. Full availability.
- b. Limited availability ($k=20$).

8. A various three-stage switching network (128x128) are designed. For each network, the number of inlet per block on the 1st stage is $n=8$. The inlet utilization is 0.1 and the number of blocks on the second stage is k . state if the network is blocking or not. If it is blocking, find P_B .
[take $k= 5, 8, 16$]

Best Wishes of Success